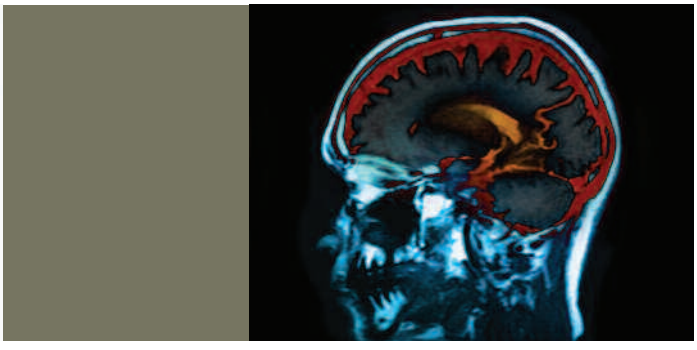
STRATEGIC OBJECTIVE 3

Improve Early Detection and Diagnosis

We will support the development and dissemination of interventions to detect and diagnose early-stage malignancy.

Detecting and diagnosing tumors early in the disease process, before the tumor becomes invasive and metastatic, can dramatically improve the patient's odds for successful treatment and survival and eliminate a large proportion of cancer deaths. For example, evidence suggests that 90 percent or more of colorectal cancer deaths could be prevented if precancerous polyps were detected with routine screening and removed at an early stage. However, the screening rate for colorectal cancer lags far behind that of other cancers, and the disease remains the second leading cause of cancer death in our Nation. For many other cancers—e.g., ovarian and pancreatic—there are no reliable early-stage screening tests to offer patients. For still others, such as lung cancer, screening tests are available but have not been proven to reduce mortality. Furthermore, although investigators continue to make promising discoveries that apply diverse technologies to early cancer detection, few of these advances have reached the patient.

By implementing the focused strategies described below, we will speed the translation of effective early detection and diagnostic approaches to the clinic. Healthcare providers and their patients will have access to sophisticated, minimally invasive procedures that harness imaging, proteomics, nanotechnology, and other advanced early detection and diagnostic techniques as well as improved access to and understanding of follow-up procedures.



STRATEGY 3.1 — Actively move research advances forward by bridging gaps across the translational spectrum.

Rapidly emerging discoveries in the laboratory promise better ways to distinguish cancer and early cancerous changes from normal tissue. To generate more effective markers for diagnosing cancer and predicting risk or treatment response, it is critical that we accelerate the movement of research findings into validation studies and clinical research where their true potential can be determined. We must improve the flow of information from basic research to development, validation, and clinical application and enhance information feedback from the clinic to basic research. NCI will:

- Support research to identify and validate specific molecular changes that occur progressively in cancer and that can be used as early diagnostic markers.
- Support an Institute-wide initiative to accelerate the clinical translation of imaging discoveries for early detection and diagnosis.
- Encourage the movement of new research areas such as micro-RNA expression and epigenetics/epigenomics to development and clinical translation.
- Develop and deploy team science mechanisms to address the variety of skills and amount of work required for post-discovery development.
- Ease the movement of research findings to clinical validation by enhancing the use of mouse models for preclinical interventions.
- Encourage research collaborations and provide incentives for developing evidence-based interventions.

Improving the flow of information among researchers and with healthcare providers will accelerate the identification of early changes that cause or promote cancer progression or metastasis and help identify risk or prognostic markers useful for developing more personalized and successful treatment regimens.

STRATEGY 3.2—Promote collaborative multidisciplinary research for validating biomarkers of early detection and screening.

In the interest of public health, it is important to ensure that biomarkers provide accurate, convincing evidence for diagnosis and conform to regulatory requirements. In the last several decades, only a few biomarkers—e.g., the Papanicolaou (Pap) test for cervical cancer, the prostate-specific antigen (PSA) test, the CA 15-3 test for breast cancer, and the CA 125 test for ovarian cancer—have found their way to clinical application for either screening or disease monitoring. This has been, in part, due to the limited rigor of studies required for clinical validation. NCI will:

- Promote collaborative, multidisciplinary research to validate biomarkers for early detection and diagnosis.
- Support research to determine whether a biomarker test predicts the true presence or absence of disease for all individuals.
- Promote research that tests the biomarker in an adequate spectrum of patients with and without cancer and accurately summarizes the sensitivity, specificity, and other performance characteristics of the test.
- Encourage public-private partnerships to provide researchers with access to necessary technologies and other resources.
- Create innovative funding mechanisms to attract multidisciplinary teams of leading scientists into this field of research.

Using rigorously evaluated biomarkers for detecting and diagnosing cancer early in the disease process will dramatically improve the survival rate for cancer patients.

STRATEGY 3.3—Develop risk factor profiles for identifying patients who are likely to benefit most from cancer screening.

General population screening for early cancer detection, although desirable in the long term, is logistically difficult, currently inefficient, and very expensive. To effectively use the promising diagnostic screening techniques that have been discovered, we must first develop risk profiles to identify the people who are likely to benefit the most from screening. NCI will:

- Develop and test techniques to screen people for risk factors using gene assessment and imaging technologies, clinical presentation, and data on lifestyle, family history, and environmental factors.

- Establish a comprehensive database of risk factors to help researchers and clinicians identify people at high risk for cancer.
- Develop and validate technologies for testing and monitoring high risk individuals for early-stage cancer and make these tests cost-effective and available to all who need them, using the principles established by NCI, the Food and Drug Administration, and the Centers for Disease Control and Prevention. These technologies will include bioinformatics-enhanced image analysis, proteomic profiling of blood and tissue, and identification of unique biomarkers or panels of biomarkers to "fingerprint" disease.
- Develop approaches for monitoring, in a secure and confidential manner, individuals identified as high risk for cancer to establish proof of concept for a personalized medicine approach.

Access to resources will allow researchers to develop ways to identify those patients who can benefit from targeted cancer screening procedures, accelerate their ability to personalize cancer diagnostic procedures, and increase the interest of industry in further developing and commercializing these techniques.

Biomarkers Prove Useful for Detection, Diagnosis, and Treatment

A biomarker is a substance found in the blood, other body fluids, or tissues at high enough levels to indicate the possible presence of disease. Examples of cancer biomarkers (also called tumor markers) include CA 125 (ovarian cancer), CA 15-3 (breast cancer), CEA (ovarian, lung, breast, pancreas, and gastrointestinal tract cancers), and PSA (prostate cancer). These markers are produced either by the tumor itself or by the body in response to the presence of cancer or certain benign (noncancerous) conditions.

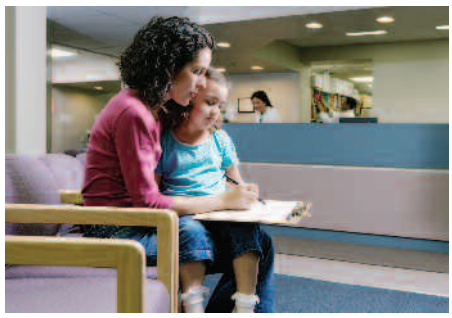
When used along with x-rays or other tests, measurements of tumor marker levels can be useful in the detection and diagnosis of some types of cancer. In addition, some tumor marker levels are measured before treatment to help doctors plan appropriate therapy. In some types of cancer, tumor marker levels reflect the extent (stage) of the disease and can be useful in predicting how well the patient will respond to treatment. Tumor marker levels may also be measured during treatment to monitor a patient's response to treatment. Finally, measurements of tumor marker levels may be a part of treatment follow-up to check for recurrence.

STRATEGY 3.4 — Encourage and provide investigator training to facilitate the development and application of diagnostic tests.

NCI must support training opportunities that will lead to collaborations among basic bench scientists, clinicians, population scientists, medical educators, and experts from other disciplines such as imaging and informatics. NCI will:

- Sustain training activities that encourage exploratory and developmental research, promote collaborations that bring together ideas and approaches from diverse scientific disciplines, and support businesses in conducting innovative research.
- Support training related to technology development, including high risk, early-stage research, and increase support for developing and validating technologies for early detection and diagnosis.
- Place greater training emphasis on innovative research activities that have high translation impact and go beyond strictly mechanistic studies.

Researchers from diverse fields who are prepared to collaborate will be better able to tackle questions about early-stage cancer diagnosis and establish a fertile environment for exchanging ideas and ensuring that only those diagnostic tests and applications with high clinical value are pursued.



STRATEGY 3.5 — Determine why abnormal findings from screening examinations have less than acceptable rates of follow-up and develop strategies to improve the system.

Research is needed to delineate the interventions necessary to ensure that health system and provider barriers are eliminated and that patients fully comprehend and recognize the importance of follow-up recommendations. New approaches are needed to link patients, providers, and advocates with health system information to ensure that patients receive and adhere to appropriate follow-up recommendations. To address these issues, NCI will:

- Collaborate internally and with other agencies to improve the level of participation of at-risk populations in screening programs, promote timely resolution of abnormal findings, and ensure uniform patient access to state-of-the-art treatments.

- Support public-private partnerships to develop needed information systems, support existing networks that have the capacity to conduct research in this area, and support workshops to develop consensus on measures for intervention and surveillance.
- Provide policymakers with the information they need to construct health policies that improve access and reduce barriers in the healthcare system.

The widespread use of existing screening tests in diverse public health settings accompanied by appropriate post-screening follow-up will significantly reduce cancer morbidity, mortality, psychosocial sequelae, and associated human and financial costs.

STRATEGY 3.6 — Develop better diagnostic and screening tools for early detection, risk assessment, and recurrence.

Increasing accuracy in the characterization of cancers at the time of diagnosis will allow physicians to develop the most appropriate treatment plan for individual patients. NCI will:

- Support the development and evaluation of high-throughput, cost-effective technologies that permit rapid and accurate patient diagnoses.
- Collaborate with patient advocacy organizations and groups conducting clinical trials to facilitate the secure and confidential collection of large numbers of tumor samples and other biospecimens. Associated clinical data on diagnosis and clinical outcome will be required for definitive evaluation of new diagnostic and screening technologies.
- Strengthen the development process with the expertise of interdisciplinary teams, including clinicians, pathologists, laboratory researchers, and statisticians.
- Conduct innovative clinical trials to test these technologies in diverse patient populations.

Validated screening and diagnostic technologies will allow clinicians to make earlier, more accurate diagnoses; identify the best therapies and preventive interventions for patients; and determine the likelihood that a tumor will recur.

STRATEGY 3.7— Make experimental data accessible across the cancer research community.

To be of maximum value to the cancer research community, experimental data must be accessible to all authorized researchers through intelligent broad-use software that offers interpretive and query functions. For example, research partners may require the exchange of data on genomics and proteomics. This level of shared data access will require user-enforced analysis and format standards so the data can be used for correlative studies. NCI will:

- Support the development of standards for submitting data into shared repositories and for inter-repository exchange. These standards will specify the minimum information required to correctly interpret experimental data housed in the repositories.
- Address the complex questions related to the feasibility of sharing raw data, including varying levels of user expertise and the intended use of the data. For example, raw mass spectra files from a proteomics experiment may be useful to developers of bioinformatics tools, whereas completed analyses of protein identifications with correlative data may be more valuable than raw data to biologists.
- Develop centralized or distributed registries to manage the electronic credentials needed to access data with security, privacy, or intellectual property limitations.
- Develop and apply guidelines to ensure that comparable data from various sources can be aggregated and that heterogeneous but related data sets—e.g., proteomics analyses and clinical assessments—can be integrated.
- Develop well documented programming interfaces that will allow researchers to mine large quantities of data.

Improving shared research data access among multiple institutions and diverse groups of investigators will expedite the translation of research results into knowledge, products, and procedures to improve human health.

STRATEGY 3.8 — Translate evidence-based research into public health and medical practice.

We have made great progress in our ability to detect and diagnose early-stage malignancy. The challenge is to effectively disseminate best practices and evidence-based cancer screening approaches across all populations. Better understanding of risk perception and communication with patients and providers is key to successful adoption of research findings into practice. NCI will:

- Support programs to communicate the benefits, risks, and limitations of cancer screening tests, as well as screening alternatives, so that people can make informed decisions about obtaining cancer screening.
- Support research to proactively identify barriers to dissemination and to develop effective strategies for implementing and sustaining evidence-based screening.
- Forge linkages among scientists, communities, and the healthcare system responsible for cancer screening.
- Partner with other agencies and cancer advocates to develop innovative research dissemination programs that will close the gap between research findings and public health practice.

Effective delivery of information on cancer screening programs will facilitate early detection, make earlier intervention possible, improve patient odds for positive outcomes, and enhance quality of life.